

SLEEP DEPRIVATION, ALLERGY SYMPTOMS, AND NEGATIVELY REINFORCED PROBLEM BEHAVIOR

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We studied the relation between the presence versus the absence of sleep deprivation or allergy symptoms and the rate and function of problem behavior. Three students whose problem behavior was negatively reinforced by escape from instruction were studied across several weeks using analogue functional analyses. Our results indicated that the extraexperimental events were associated with (a) termination of instruction functioning as a negative reinforcer, (b) increased rates of negatively reinforced problem behavior, or (c) increased rates of problem behavior across all conditions.

DESCRIPTORS: severe disabilities, problem behavior, interaction effects, functional analysis, establishing operations

Functional analysis has led to important advances in the assessment and treatment of problem behavior. However, a complication sometimes encountered in functional analyses is periodic fluctuations in response rate. A potential source of this variability is the occurrence of events such as menses, sleep deprivation, or allergies. Recently, investigators have begun to analyze the effects that events such as sleep deprivation may have on rates of problem behavior (e.g., Kennedy & Itkonen, 1993; O'Reilly, 1995). These recent studies suggest a complex functional relation between extraexperimental events and variability in response rate. The purpose of the current investigation was to assess the effects sleep deprivation or allergy symptoms may have on negatively reinforced problem behavior during analogue functional analyses.

METHOD

Participants and Setting

Marcello was 15 years old, ambulatory, and diagnosed as profoundly retarded, and had a 12-year history of head banging and hitting others or objects. Mimi was 18 years old, ambulatory, and diagnosed with moderate retardation, and hit others and threw objects. Rudolfo was 13 years old, nonambulatory, and diagnosed as profoundly retarded, and bit his arms and hands. No participant was taking prescription medication. Sessions were conducted in classrooms with similar dimensions (9 m square) and arrangements (several tables and chairs were present).

Allergy Symptoms and Sleep Deprivation

Using descriptive analyses and interviews, allergy symptoms (Rudolfo) and sleep deprivation (Marcello and Mimi) were identified as events correlated with elevated rates of problem behavior. For Rudolfo, allergy symptoms included the presence of swollen, reddened, and irritated eyes and excess nasal mucus. For Marcello, sleep deprivation occurred when he stayed awake past his typical bedtime (i.e., until 2:00 a.m. to 3:00 a.m.), and often proceeded to attack his mother from the time he awakened until he depart-

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Session-by-session graphic displays for each participant and reprints are available from Craig H. Kennedy, College of Education, 1776 University Avenue, University of Hawaii, Honolulu, Hawaii 96822 (E-mail: kennedy@hawaii.edu).

ed for school. When this happened, his mother placed him in an oversized jacket with the arms tied at the back. Documentation of these events included Marcello's arrival at school wearing the jacket and parent-teacher communication via a notebook regarding sleep and problem behavior. Mimi's sleep cycles appeared to vary from a night of full sleep to a night of minimal sleep (i.e., staying awake until after midnight). Documentation of her sleep deprivation occurred via a phone call to her teacher by her parents and the cooccurrence of signs of sleep deprivation (i.e., arriving at school asleep and appearing drowsy when awake). Teachers and parents separately recorded the events for each student, and 100% agreement was obtained for the occurrence and nonoccurrence of sleep deprivation and allergy symptoms.

Functional Analysis

A multielement design assessed the operant function of problem behavior across four conditions in the presence and the absence of allergy symptoms (Rudolfo) or sleep deprivation (Marcello and Mimi). The four experimental conditions included (a) attention, (b) demand, (c) no attention, and (d) recreation. In the attention condition, an instructor and student sat next to each other at a table. The instructor engaged in paperwork while the student was presented with several activities (see recreation condition). If the student emitted a problem behavior, the instructor provided 5 s of social comments to the student (including a statement not to engage in the problem behavior). Each reoccurrence of problem behavior after 5 s of social comments occasioned a similar consequence. This procedure was modified for Marcello by having two adults sit at the table and converse with each other. In the demand condition, an instructor made a verbal demand every 10 s. If a correct response was emitted by the student, the instructor

praised him or her. If an incorrect response was emitted by the student or no response occurred after 5 s, the instructor provided full physical assistance. If a problem behavior occurred, all demands were terminated for 15 s (for Marcello demands were terminated for 30 s). In the no-attention condition, the student sat at a table with no social interaction or activities (the instructor stood 6 to 8 m away). In the recreation condition, the student was provided with various preferred activities and was praised noncontingently every 15 s in the absence of problem behavior. For Marcello, praise was delivered noncontingently every 30 s. Each condition, lasting 10 min, was presented once per day in a random sequence, 3 to 5 days per week. A total of 52, 36, and 60 sessions were conducted for Rudolfo, Marcello, and Mimi, respectively.

Interobserver Agreement

Interobserver agreement for frequencies of problem behavior was calculated on a point-by-point basis as total number of agreements divided by agreements plus disagreements multiplied by 100%. For duration, a frequency-ratio formula was used: smaller total divided by larger total multiplied by 100%. Agreement estimates were collected on 56%, 33%, and 31% of sessions for Marcello, Mimi, and Rudolfo, respectively. Agreement estimates for problem behavior were 98% (range, 86% to 100%), 96% (range, 88% to 100%), and 98% (range, 92% to 100%) for Marcello, Mimi, and Rudolfo, respectively.

RESULTS AND DISCUSSION

Table 1 indicates that Rudolfo's problem behavior was negatively reinforced by escape from demands only when allergy symptoms were present. Increased levels of problem behavior were also observed in the attention condition. Results for Marcello indicated that his problem behavior was negatively re-

Table 1
Functional Analysis Results

Student	Experimental conditions			
	Attention	Demand	No attention	Recreation
	<i>M</i> (range)	<i>M</i> (range)	<i>M</i> (range)	<i>M</i> (range)
Rudolfo ^a				
No allergy symptoms	0	1.4 (0 to 7)	0	0
Allergy symptoms	44 (0 to 117)	102 (61 to 185)	5 (0 to 17)	3 (0 to 12)
Marcello ^b				
No sleep deprivation	1.6 (0 to 2.9)	4.7 (3.5 to 5.4)	0.7 (0.2 to 1.1)	0.5 (0.1 to 0.7)
Sleep deprived	1 (0.4 to 1.6)	7.1 (5.3 to 8)	0.9 (0.3 to 0.9)	1.4 (0.4 to 2.8)
Mimi ^b				
No sleep deprivation	0.4 (0.1 to 0.9)	3.2 (2.5 to 4.9)	0.2 (0 to 0.5)	0.1 (0 to 0.3)
Sleep deprived	2.9 (1.7 to 4.6)	5.7 (4.8 to 6.5)	2.8 (0.9 to 4)	3 (1.4 to 4.9)

^a Duration (seconds).

^b Responses per minute.

inforced by escape from instruction and that sleep deprivation was associated with an increased frequency of escape-related problem behavior. Mimi's results indicated that when she was not sleep deprived, her problem behavior appeared to be maintained by negative reinforcement. When she was sleep deprived, however, the mean frequency of problem behavior was higher across conditions, relative to no sleep deprivation.

Although we did not directly manipulate allergy symptoms or sleep deprivation, our findings indicate that these events influenced the effects of the experimental contingencies on problem behavior for each student. Our findings further the work of Kennedy and Itkonen (1993) and O'Reilly (1995) and suggest two broad areas in need of further attention. First is the extension of experimental analyses to events that may occur outside functional analysis assessments. If these events can be precisely defined, measured, and, if possible, controlled, a better understanding of variability in response rate may result, with corresponding improvements in assessment and intervention. A second issue is the conceptualization of the effects of events such as menses, allergy symptoms, and sleep deprivation. One possible

approach is to consider the effects of such events as establishing operations (Michael, 1982). Although these events appear to alter the value of available reinforcers without altering other aspects of a three-term contingency, their role in influencing specific versus broad response-reinforcer relations needs to be more adequately understood prior to their classification as establishing operations (J. L. Michael, personal communication, June 24, 1995). This will require increased experimental attention to a variety of response-reinforcer relations and further consideration of the theoretical nature of establishing operations.

REFERENCES

- Kennedy, C. H., & Itkonen, T. (1993). Effects of setting events on the problem behavior of students with severe disabilities. *Journal of Applied Behavior Analysis*, 26, 321-327.
- Michael, J. L. (1982). Distinguishing between discriminative and motivational functions of stimuli. *Journal of the Experimental Analysis of Behavior*, 37, 149-155.
- O'Reilly, M. F. (1995). Functional analysis and treatment of escape-maintained aggression correlated with sleep deprivation. *Journal of Applied Behavior Analysis*, 28, 225-226.

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